

The *Diplodactylus ciliaris* complex (Lacertilia: Gekkonidae) in Western Australia

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Abstract

In Western Australia the *Diplodactylus ciliaris* complex, i.e. *D. ciliaris sensu* Kluge, consists of five taxa, namely from north to south *D. ciliaris ciliaris* Boulenger, *D. ciliaris aberrans* Glauert, *D. wellingtonae* sp. nov., *D. assimilis* sp. nov. and *D. intermedius* Ogilby.

Introduction

In his monograph of the genus *Diplodactylus*, Kluge (1967) was sorely hampered by paucity of material when studying its widest spread and most variable 'species', *D. ciliaris*. He divided it into two subspecies, *D. c. ciliaris* and *D. c. intermedius*; the first was further divided into eight populations (three in Western Australia). Additionally he classified certain specimens as hybrids between *D. c. ciliaris* and *D. c. intermedius*.

Kluge's five formal and informal units in Western Australia are essentially the same as the five taxa recognised by me: his '*D. c. ciliaris* population 1' = my *D. c. ciliaris*; '*D. c. ciliaris* population 5' = *D. c. aberrans*; '*D. c. ciliaris* population 8' = *D. wellingtonae*; '*D. c. ciliaris* population 8 x *D. c. intermedius*' = *D. assimilis*; and '*D. c. intermedius*' = *D. intermedius*. Only two specimens do not conform to these equations: R15137 from dunes south of Warburton was placed by Kluge in '*D. c. ciliaris* population 3', by me in *D. c. aberrans*; and R15123 from Queen Victoria Spring was placed by Kluge in '*D. c. intermedius*', by me in *D. assimilis*.

This revision is based on material in the Western Australian Museum (R prefixes usually omitted from catalogue numbers) and on colour slides kindly loaned by G. Harold, R.E. Johnstone, G. Shea and M. Peterson.

Diplodactylus ciliaris ciliaris Boulenger

Diplodactylus ciliaris Boulenger (1885: 98; Pl. 8, Fig. 2). Port Darwin, NT.

Diagnosis

A large member of the complex (total length up to 138 mm) with long spines above eye and on tail. Differing from *D. c. aberrans* mainly in small non-spinose scales on top and side of tail being granular rather than tubercular.

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Description

Snout-vent length (mm): 35-86 (N 83, mean 66.8). Length of tail (%SVL): 53-74 (N 55, mean 63.9).

Nostril surrounded by rostral (median groove almost invariably complete), two supranasals (anterior larger), one postnasal (occasionally two, rarely three) and first labial. Internasals 0-3 (N 61, mean 1.2). Upper labials 11-16 (N 57, mean 13.4), 8-12 (mean 9.9) to middle of eye. Under side of digits with pair of large apical plates, followed on fourth toe distally by 4-7 (N 47, mean 4.3) transverse lamellae and proximally by 1-4 (mean 2.4) pairs of elliptic or circular scales. Pre-anal pores in males, 3-10 on each side.

Usually two long black spines above eye, posterior longer (occasionally three or four and dark brown, rarely pale). Usually two short, pale or partly pale spines behind eye. Dorsal tubercles usually without regular arrangement, usually low (occasionally high), and orange, brown or black. Two rows of long (occasionally medium) spines on tail, mostly orange but commonly black.

Upper and lateral surfaces blackish grey or dark brownish grey, so patterned as to leave a vague, pale grey loreotemporal stripe and an upper lateral series of 4-7 large, pale grey, rounded quadrilateral blotches on neck and body. Iris greyish white with a fine black anastomosis or reticulum, except for orange periphery. Mouth orange or yellow.

Distribution

Far north and north-east of Western Australia (south and west to Beverley Springs, Tableland, Carranya, Lake Gregory and far north of Tanami Desert) and northern half of Northern Territory (south to 65 km S Tennant Creek). See map, Figure 1.

Geographic variation

The above colour description applies to specimens from Western Australia and the arid interior of Northern Territory. In the far north of Northern Territory (south to Dunmara) the upper and lateral surfaces are more brownish, the upper lateral blotches tend to be replaced by clusters of white dots, the top of head and tail and sometimes the back, elbows and knees are marked with reddish brown or orange-red, and the iris is brownish orange dotted with whitish except for narrow white margin to pupil and whitish periphery.

Material

Kimberley Division (WA)

Parry Harbour (40742); Kalumburu (70119); Drysdale River National Park (50301-11, 50328, 50395-7, 50399, 50411-2, 50461-2, 50551-2, 50764-5, 50770, 50798); Mitchell Plateau (43148, 43513, 56305, 58320); 5 km NW Noachitty Rapids, Morgan River (57154); King Edward River crossing, Port Warrender track (56432); Mitchell Plateau (43148, 43513, 56305, 58320); 17 km ESE Kuri Bay (40396-7); Gibb River crossing, 47 km N Gibb River HS (57128-32); 15 km NNE Kununurra (87224) and 19 km ESE (87358) and 33 km SE (87128) and 27 km S (70086); 7 km E Mt Rob (83360); 3 km E Ord River dam (39997); 13 km NNW Mt

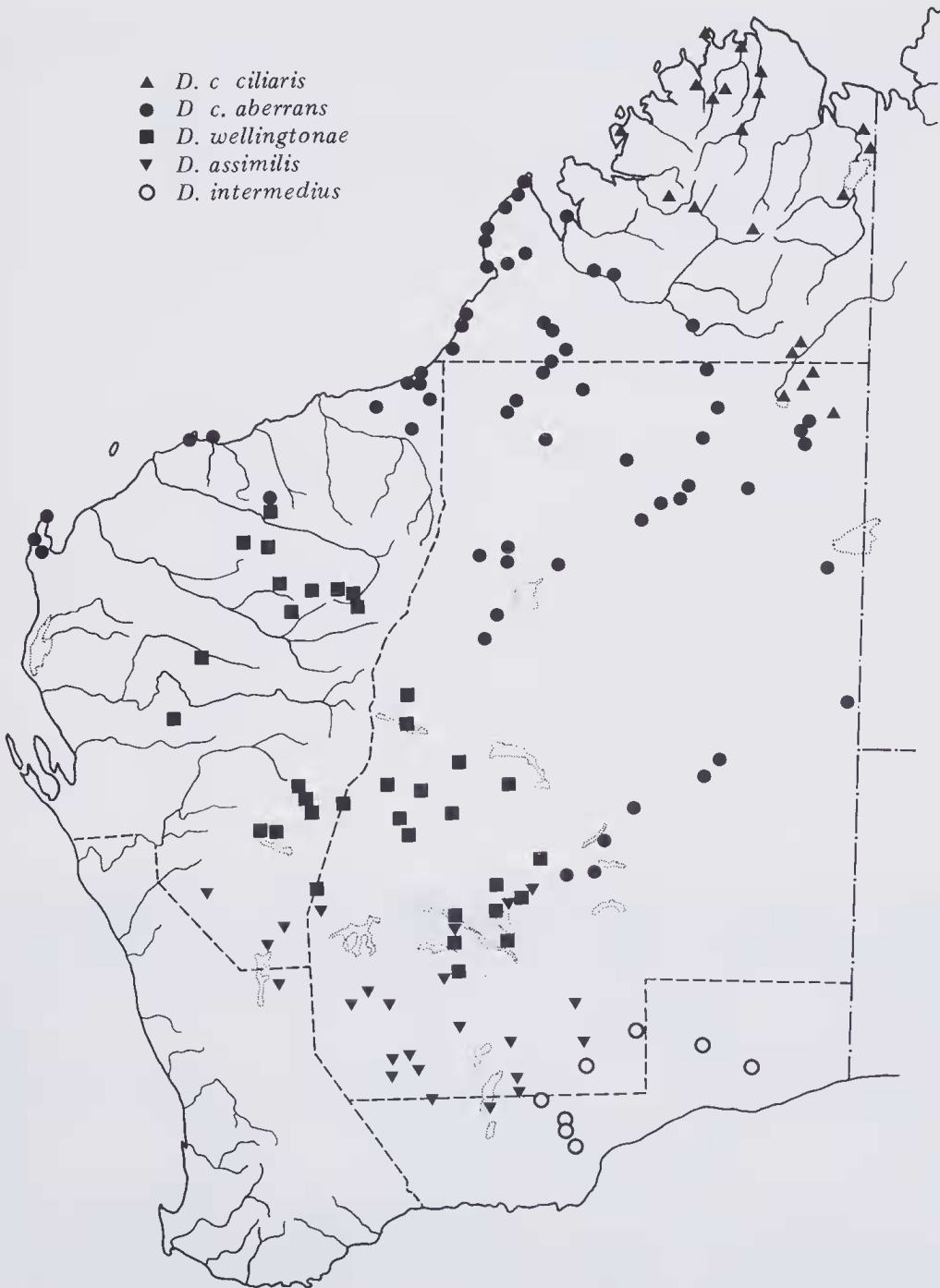


Figure 1 Map of Western Australia showing location of specimens of *Diplodactylus ciliaris*, *D. c. aberrans*, *D. wellingtonae*, *D. assimilis* and *D. intermedius*.

Diplodactylus ciliaris complex

Evelyn (70959); 12 km NW (new) Lissadell (71102); Manning River, Mt Barnett (32305); Beverley Springs (56925); 20 km ENE Tableland HS (58618-20); 2 km E Wolf Creek Meteorite Crater (64038-9); 9 km SSW Carranya (58667-9).

Eastern Division (WA)

33 km SE Billiluna (83530) and 42 km ESE (83527-8); Bungabiddy Well (64057-8); near Lake Gregory HS (63305-7); 36 km SE McGuire Gap (63272-3).

Northern Territory

47 km NW Pine Creek (23220); near Katherine (55864, 74018); Dunmara (85128-9); Barry Caves (55471) and 71 km W (55441); 16 km E Tennant Creek (24242) and 65 km S (21388-92).

Diplodactylus ciliaris aberrans Glauert

Figure 2

Diplodactylus spinigerus aberrans Glauert (1952: 167). Mt Wynne, WA.

Diagnosis

A large member of the complex (total length up to 149 mm) with long spines above eye and on tail. Differing from *D. c. ciliaris* mainly in non-spinose scales on top and side of tail being tubercular rather than granular, and in caudal spines and dorsal tubercles being more frequently black than orange.

Description

Snout-vent length (mm): 29-89 (N 253, mean 70.3). Length of tail (%SVL): 54-79 (N 184, mean 66.0).

Nostril surrounded by rostral (median groove complete), two supranasals (anterior larger), one postnasal (rarely two) and first labial. Internasals 0-3 (N 70,



Figure 2 A *Diplodactylus ciliaris aberrans* from Anna Plains photographed by G. Harold.

mean 1.1). Upper labials 11-16 (N 68, mean 13.4), 8-12 (mean 10.2) to middle of eye. Under side of digits with pair of large apical plates, followed on fourth toe distally by 3-6 transverse lamellae (N 42, mean 3.9) and proximally by 0-4 (mean 2.3) pairs of elliptic or circular scales. Pre-anal pores in males, 2-9 on each side.

Usually two long black spines above eye, posterior longer (occasionally one, three or four, and rarely dark or pale brown). Usually two short pale or partly pale spines behind eye (occasionally black or dark brown). Dorsal tubercles (when present) not arranged in regular pattern, usually low (occasionally high), and mostly black but commonly pale or dark brown. Two rows of medium to long spines on tail, mostly black but commonly wholly or partly orange-brown or pale brown. Non-spinose scales on top and side of tail black or pale, low to moderately high tubercles.

Upper and lateral surfaces pale grey to blackish grey, so patterned as to leave a pale grey loreotemporal stripe and 3-5 large pale blotches on side of neck and body. Iris white or greyish white with a black or greyish black reticulum or anastomosis except for orange-brown periphery. Mouth orange-yellow or mustard-yellow.

Distribution

Arid and semiarid Western Australia from west Kimberley south along the coast to the Cape Range and in the interior through the Great Sandy, Little Sandy, Gibson and Great Victoria Deserts to Lake Yeo. In the far north-east (at Christmas Creek and south of Gregory Salt Lake) it intergrades with *D. ciliaris*. See map, Figure 1.

Material

Kimberley Division (WA)

Point Torment (58561-4, 58567, 58572, 60836); Lombadina Creek (58428); Pender Bay (58384); Beagle Bay (56445); Cape Bertholet (58400, 58449); near Coulomb Point (58417-23, 60860, 60888, 83361-2, 83522-6); 33 km E Kildo (87025); 13 km NE Roebuck Plains (87047) and 11 km NW (87050); Broome (14092, 83529, 87019, 94586, 95556-7); Mt Anderson (11601, 32174); Mt Wynne (2803, holotype); Christmas Creek (26030); Edgar Ranges (53888-91, 53902-3, 53941-5, 53951-5, 53958, 53978-9, 53982-5, 53996-7, 54002, 54006, 54032, 54072, 54081-9); La Grange (3442, 4292, 82709-10) and 16 km S (27400-1); Frazier Downs (28420); Anna Plains (58940) and 12 km E (60174-6) and 14 km SSE (79031); McLarty Hills (57269, 57301, 75812) and 25 km NE (46050).

North-west Division (WA)

31 km SSW Anna Plains (75144); Mandora Creek (63219-20, 73023-8); Sandfire (87015); Wallal (1003); 34 km NE Bulgamulgardy Soak (63191-208, 74816-23); 51 km N Shay Gap (73011); 29 km NE Callawa (63175); Cape Lambert (68294, 68296); Dampier (68998); Hooley (10856); Vlaming Head (14146); Yardie (15215); Exmouth (25584, 52998, 80821) and 6 km S (74945, 78896, 81329); Cape Range (25099); Mandu Mandu Creek (82527); Yardie Creek (61096, 61168-70, 61412, 61473, 61480-1, 61487); 40 km NE Ningaloo (21766).

Eastern Division (WA)

Dragon Tree Soak (75805, 81657); 34 km S Boundary Hill (63258-9); near Joanna Spring (73806-7, 75753, 75759, 75773); Anketell Ridge (69521); 190 km ESE Mandora (57280); Breaden Pool (64113); 32 km S Balgo (47680); 28 km E Bishops Dell (69904, 69915); 35 km

SW McTavish Claypan (64275); 4 km NW Gravity Lakes (64146); north-west end Stansmore Range (57046); 29 km W Thompson Hills (94958-60, 94983); 50 km N Wilson Cliffs (57051); near Well 40, Canning Stock Route (63449-50, 64152); Well 39, C.S.R. (3975, 63517-20, 64159, 64218); 16 km S Well 38, C.S.R. (40939); 11 km NNW Well 37, C.S.R. (63555); Well 35, C.S.R. (63559-61); 80 km S Telfer (94762-3); 29 km S Nooloo Soak (64016-7) and 31 km SSE (63743); 75 km W Well 23, C.S.R. (40165); Well 24, C.S.R. (27026); Mt Webb (57069); Durba Hills (40326-7); 83 km S Killagurra Spring (51952-3); 13 km S Warburton (15137); Winduldarra Rockhole (48642, 48644); 12 km SW Terhan Rockhole (34313); Point Sunday (53581) and 8 km E (53576-7); Point Salvation (82166-208).

Diplodactylus wellingtonae sp. nov.

Figure 3

Holotype

R15218 in Western Australian Museum, collected by G.M. Storr on 23 August 1961 at 40 km NE Laverton, WA, in 28°23'S, 122°35'E.

Paratypes

For details of 61 specimens see Material.

Diagnosis

A large, long-tailed member of the complex (total length up to 145 mm) with long spines above eye and on tail. Differing from *D. ciliaris ciliaris* and *D. c. aberrans* in dorsal tubercles being arranged in two parallel rows (rather than scattered over back), all spines and tubercles being orange or brown (never black) and mouth being bluish (not yellowish).

Description

Snout-vent length (mm): 49-85 (N 62, mean 68.2). Length of tail (%SVL): 59-80 (N 44, mean 69.0).

Nostril surrounded by rostral (median groove almost invariably complete), two supranasals (anterior much the larger), one postnasal (occasionally two) and first upper labial. Internasals 0-3 (N 42, mean 1.4). Upper labials 10-15 (N 41, mean 13.0), 8-12 (mean 9.9) to middle of eye. Under side of digits with pair of large apical plates, followed on fourth toe distally by 3-5 (N 31, mean 4.2) transverse lamellae and proximally by 1-3 (mean 2.2) pairs of elliptic or circular scales. Pre-anal pores in males, 3-9 on each side.

Usually two medium to long, brown spines above eye, posterior longer (occasionally three, four or five). Usually two (rarely three) pale or dark brown spines behind eye. Dorsal tubercles almost always arranged in two parallel rows (occasionally absent anteriorly, very rarely absent posteriorly), low to high, and orange (occasionally brown or whitish). Two (very rarely four or six) rows of medium to long spines on tail, usually orange. Non-spinose scales on top and side of tail small and granular.

Upper and lateral surfaces pale grey to dark grey, usually so patterned as to leave a pale grey loreotemporal stripe and 5-8 pale grey, roughly quadrilateral



Figure 3 A *Diplocladon wellingtonae* from Millbillillie photographed by G. Harold.

blotches on side of neck and body (pale markings sometimes confluent and edged with black). Iris greyish white with a black reticulum or anastomosis, except for maroon periphery. Mouth dark blue or blue-black.

Distribution

Arid western plateau of Western Australia from the Pilbara south-southeast to Menzies. See map, Figure 1.

Derivation of name

After Mrs Betty D. Wellington of Mt Helena in recognition of her services to Western Australian natural history.

Material

North-west Division (WA)

15 km S Hooley (74869, 74871); 2 km W Hamersley HS (74926); Marandoo (69788); 61 km NW Prairie Downs (61788); 31-35 km SW Mt Meharry (66315-6); Ophthalmia Range (54231); 10 km NE Mt Newman (51621); 2 km S Capricorn Roadhouse (81320); 10 km S Turee Creek (83730); Mt Augustus (52883, 52889); Glenburgh (28954); Meekatharra district (22709); 32 km SSW Paroo (84377); Gabanintha (5194); Quinns (328-9); Nallan (15216); Austin Downs (8963); Cue district (735-6); 23 km SSW Anketell (84434).

Eastern Division (WA)

Carnarvon Range (51920-1); Canning Gap (36714); Lorna Glen (94713); 26 km W Prenti Downs (87491); 20 km E Millbillillie (87484-6); Wiluna (29638) and 57 km E (21112); 3 km E White Well (87463); Wonganoo (60520); near Albion Downs (30973); 21 km SE Mt Keith (62785-8); Kathleen Valley (19769, 27216); 20 km NNW Mt Windarra (70850); Laverton (142, 11565) and 40 km NE (15219) and 12 km S (56005-6); Leonora (10019) and 27 km S (95548) and 40 km S (86638) and 48 km S (15217, 86640); Mt Linden (65871, 65997, 72762) and 8 km SSE (72895); 4 km N Jeedamy HS (95544); 7 km N Menzies (95551); 12 km NE Comet Vale (65819) and 14 km ENE (65778).

Diplodactylus assimilis sp. nov.

Figure 4

Holotype

R72164 in Western Australian Museum, collected by J. Dell on 22 April 1980 at 15 km NE Bungalbin Hill, WA, in 30°18'S, 119°44'E.

Paratypes

For details of 67 specimens see under Material.

Diagnosis

A small member of the complex (total length up to 128 mm long), very like *D. intermedius* but larger and having a relatively longer tail, fewer internasals (mode 1, v. 3) and dorsal tubercles arranged in two wavy or discontinuous rows (not two continuous parallel rows). Distinguishable from *D. wellingtonae*, *D. ciliaris ciliaris* and *D. c. aberrans* by much shorter spines above eye and on tail.

Description

Snout-vent length (mm): 26-78 (N 67, mean 58.1). Length of tail (%SVL): 55-73 (N 52, mean 64.3).

Nostril surrounded by rostral (median groove almost invariably complete), two supranasals (rarely three, anterior usually larger), one postnasal (occasionally two) and first labial. Internasals 0-3 (N 60, mean 1.3). Upper labials 10-16 (N 65, mean 12.6), 7-14 (mean 9.8) to middle of eye. Under side of digits with pair of large apical plates, followed on fourth toe distally by 3-7 (N 54, mean 4.4) transverse lamellae and proximally by 1-5 (mean 2.2) pairs of elliptic or circular scales. Pre-anal pores in males, 2-10 on each side.

Spines above eye 0-7, very to moderately short, usually dark (occasionally pale or partly pale). Usually one or two spines (occasionally none) behind eye, short and usually dark. Dorsal tubercles usually large and high, mostly orange or orange-brown, all or the largest arranged on each side in a deeply wavy line or a discontinuous line (groups of 2-4 tubercles on outer part of waves, those on inner part missing). Caudal spines (*recte* tubercles) very to moderately short, triangular, orange or orange-brown, usually arranged in whorls, the largest tubercles aligning in two laterodorsal rows.

Upper and lateral surfaces medium to dark grey, so patterned as to leave a pale grey loreotemporal stripe and 5-8 large, pale grey blotches on side of neck and body (pale grey markings usually dark-edged, and lateral blotches usually



Figure 4 A *Diplodactylus assimilis* from Laverton photographed by G. Harold.

confluent). Iris greyish white with black anastomosis, except for narrow black peripheral ring. Mouth blue-black.

Distribution

Arid and semiarid southern interior of Western Australia from Yalgoo and White Cliffs south to Paynes Find, Jilbadji Nature Reserve (Boodarding Rock) and Norseman, and east to Queen Victoria Spring, 17 km E Zanthus and Heartbreak Ridge. See map, Figure 1.

Remarks

The so-called hybrid '*Diplodactylus c. ciliaris* x *D. c. intermedius*' of Kluge (1976: 1073) belong here. In many respects (colouration, size, relative length of tail and number of upper labials and subdigital lamellae) *D. assimilis* is intermediate between *D. wellingtonae* and *D. intermedius*. However, *D. wellingtonae* is now partly sympatric with *D. assimilis*. Moreover, in the less regular arrangement of the dorsal tubercles and in the colour of the iris, *D. assimilis* differs from both *D. wellingtonae* and *D. intermedius*.

Derivation of name

Latin for similar (to the closely related *D. intermedius*).

Material

North-west Division (WA)

Yalgoo (75576); Mt Kenneth (49283); Paynes Find (60922-3).

Eastern Division (WA)

White Cliffs (20651-4, 53335, 56011, 85442-4); Laverton (1304); Yuinmery (69068-70); 28 km S Leonora (86639) and 50 km S (86641); 17 km N Jeedamyra (95545-6); 10 km SW Kookynie (53290); Comet Vale (95549) and 4 km N (95550); 10 km ESE Mt Manning Range (78694); Queen Victoria Spring (15213, 48657-8); 4 km NNE Mt Jackson (76034-5, 76044-7); 15 km NE Bungalbin Hill (67174, 72165-70, 72213, 76141, 76195, 76218-9, 76226-7) and 20 km NE (67184) and 16 km NE (67109) and 12 km NE (67122, 67124, 72112); 10 km NW Kalgoorlie (30040); 17 km E Zanthus (15214); Cowarna Downs (14211); 25 km E Yellowdine (61322); Karalee (30851-2); 21 km S Woolgangie (78724); Boodarding Rock (78765, 78776); 32 km N Heartbreak Ridge (74502) and 18 km N (72362).

Eucla Division (WA)

7 km NE Norseman (94595).

Diplodactylus intermedius Ogilby

Figure 5

Diplodactylus intermedius Ogilby (1892: 10). Interior of New South Wales.

Diagnosis

A very small, short-tailed member of the complex (total length up to 92 mm long), very like *D. assimilis* but smaller and having a relatively shorter tail, more

internasals (mode 3, v. 1), and dorsal tubercles arranged in two continuous parallel rows. Distinguishable from *D. wellingtonae*, *D. ciliaris aberrans* and *D. c. ciliaris* by much shorter spines above eye and on tail.

Description

Snout-vent length (mm): 41-58 (N 19, mean 50.2). Length of tail (%SVL): 58-66 (N 15, mean 60.9).

Nostril surrounded by rostral (median groove complete), two (rarely three) supranasals (anterior larger), one postnasal (rarely two) and first labial. Internasals 1-3 (N 17, mean 2.7). Upper labials 10-14 (N 19, mean 11.5), 7-11 (mean 9.0) to middle of eye. Under side of digits with pair of large apical plates, followed on fourth toe distally by 4-7 (N 16, mean 5.0) transverse lamellae and proximally by 1-3 (mean 2.0) pairs of elliptic or circular scales. Pre-anal pores in males, 3-7 on each side.

Spines above eye 0-5, very short and dark (rarely partly pale). One spine behind eye (rarely two), very short and usually dark. Dorsal tubercles usually large, high, orange-brown and closely spaced in two continuous parallel lines. Caudal spines (*recte* tubercles) very short, triangular, orange-brown or pale brown, arranged in whorls, the largest tubercles aligning in two laterodorsal rows.



Figure 5 A *Diplodactylus intermedius* from Caiguna photographed by G. Harold.

Upper and lateral surfaces medium to dark grey, so patterned as to leave a wavy, black-edged, pale grey, upper lateral stripe on head, neck, body and tail. Iris greyish white with a black anastomosis, except for maroon peripheral ring. Mouth blue-black.

Distribution

Arid and semiarid south-eastern interior of Western Australia, west to the Fraser Range. Also southern South Australia, interior of New South Wales and north-western Victoria. See map, Figure 1.

Material

North-west Division (WA)

Kanandah (39710); 11 km ENE Buningonia Spring (74530) and 6 km SE (72545).

Eucla Division (WA)

Near Haig (91350, 91817); 55 km S Loongana (91554-5); 15 km E Kilidwerinia Granite Rock (91351) and 5 km ESE (19349); Fraser Range (72428); 18 km E Boingaring Rocks (57929); 17 km N Charlina Rock (59852); Coragina Rock (59743).

Discussion

To a large extent the members of the *Diplodactylus ciliaris* complex geographically replace each other in Western Australia. Certain of my assessments of their taxonomic status are therefore subjective and require explanation.

Diplodactylus c. ciliaris occurs mainly in the eucalypt woodlands of the northern subhumid and semiarid zones. *D. c. aberrans* is essentially an inhabitant of wattles and other shrubby acacias growing on red sands in the arid zone. The extension of this soil type to the pindan country of Dampier Land and the opposite shore of King Sound has enabled *D. c. aberrans* (and other desert reptiles) to occupy part of semiarid west Kimberley. Nevertheless there is still a considerable geographic gap between the two subspecies in this region (the King Leopold Ranges and the sparsely wooded grassy plains to their south-west are evidently unsuitable for *D. ciliaris*). In the absence of gene flow the two subspecies are sharply differentiated in the west.

In the arid north-eastern interior of Western Australia *D. c. ciliaris* has spread southwards into the northern sector of the Tanami Desert and has made contact with *D. c. aberrans*. Gene flow between the two taxa south and west of Gregory Salt Lake has so blurred the boundary between them that their conspecificity cannot be questioned.

Diplodactylus wellingtonae, an inhabitant of mulga *Acacia aneura* scrubs on the heavy soils of the Precambrian Shield, extends north to the southern Pilbara. Here it is surrounded by *D. c. aberrans* in the sandy lowlands to its north-west, north and east. Despite this parapatry (and possible sympatry on Hooley Station) there is no evidence for introgression between them. Indeed they are so different, it would be difficult to postulate that one of them evolved from the other. I

therefore agree with Kluge (1967: 1070) that *D. wellingtonae* is probably derived from the Central Australian 'populations 2 and 3'. However, it is now marooned on the western plateau of Western Australia and is separated from Central Australia by the desert populations of *D. c. aberrans*.

Diplodactylus wellingtonae extends south to the mulga-eucalypt line. In the far south-east of its range it overlaps without hybridising with *D. assimilis*. This is the only (or only extensive) instance of sympatry between two members of the complex in Western Australia. This sympatry seems to have been achieved without ecological differentiation. At any rate, several of the *D. assimilis* collected in the zone of overlap came from mulga scrubs that appeared just as suitable for *D. wellingtonae*.

Diplodactylus assimilis is an ecologically flexible species, occupying a wide variety of habitats north and south of the mulga-eucalypt line. Although allopatric to *D. intermedius*, and not very different morphologically, *D. assimilis* is treated as a full species, because there is no indication of gene flow between the two, despite their geographic proximity. At 17 km east of Zanthus, only 40 km separate *D. assimilis* from a *D. intermedius* locality (11 km ENE Bunin-gonia Spring).

References

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